SCIENCE

[Entered at the Post-Office of New York, N.Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

SEVENTH YEAR.
VOL. XIV. No. 338.

NEW YORK, JULY 26, 1889.

SINGLE COPIES, TEN CENTS.
$3.50 PER YEAR, IN ADVANCE.

THE BRUSH ELECTRIC COMPANY'S NEW ALTERNATING-CURRENT SYSTEM.

THE end attained in the system of long-distance transmission of electrical energy illustrated herewith has been reached by an abandonment of the long-traversed routes already familiar to the public.

A glance at the dynamo (Fig. 1) shows that it is compact, simple, and symmetrical. An examination shows that it is of the alternating type; that its field-magnets are many, and carried by the shaft; that the armature is fixed, and absolutely free from any magnetic material; that its parts are easily accessible; and that

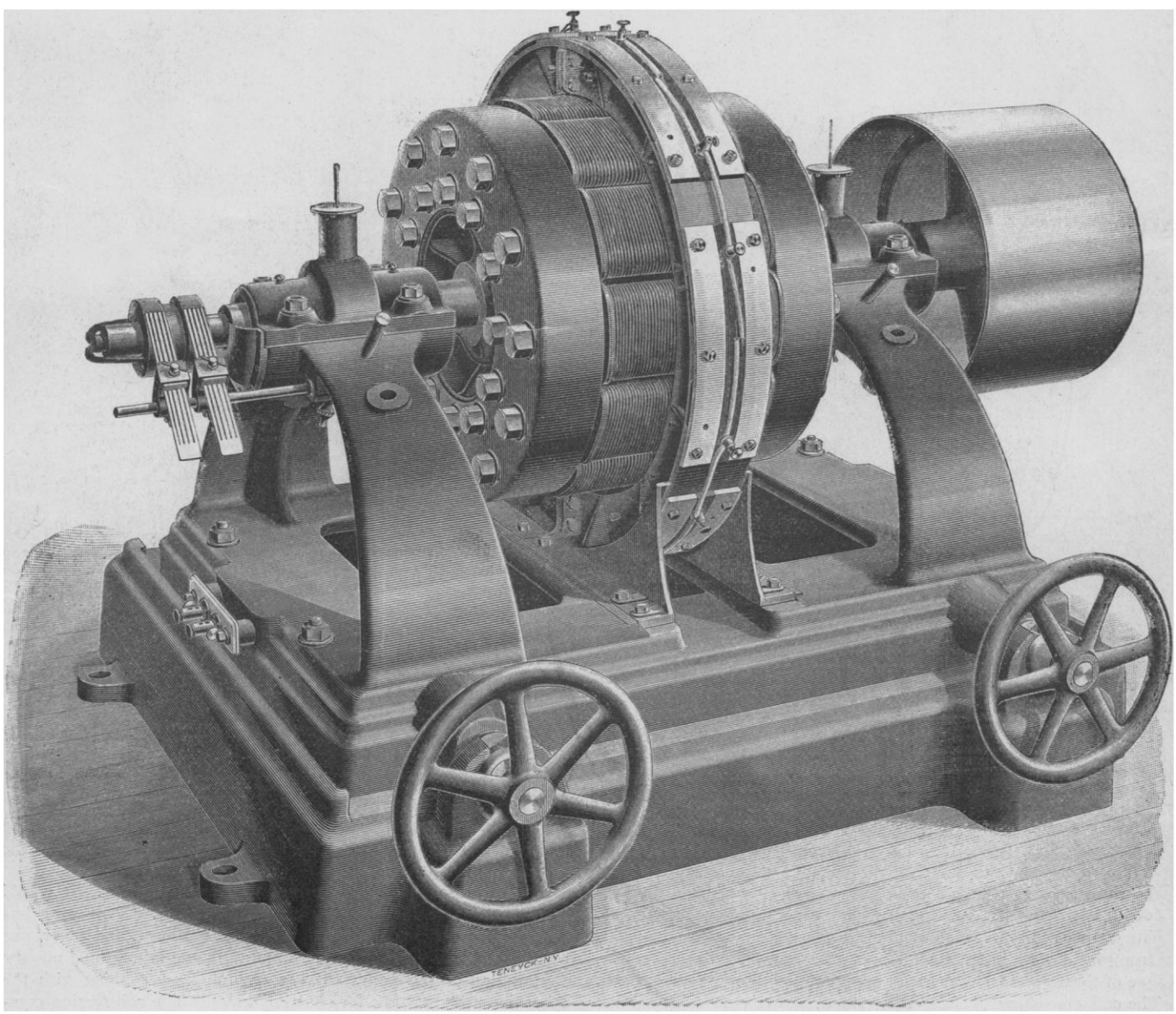


FIG. 1.—NEW BRUSH ALTERNATING-CURRENT DYNAMO.

The underlying principle of the "coreless" dynamo here illustrated was discovered and applied by Mr. Brush more than ten years ago, and new demands have now called for its extended application on a regular scale.

an armature-coil may be cut out, removed, or replaced without stopping the machine. The machine illustrated has an output of 60,000 watts, and supplies current for a thousand 16-candle-power lamps.

The shaft bearings, bearing standards, base plate, and armature-slides are cast in one piece. The shaft carries two heavy cast-iron yoke-pieces 27 inches in diameter. To each of these are screwed, at equal radial and circumferential distances, the wrought-iron cores of 12 magnets of alternating polarity. Thus the whole rotating mass acts as a fly-wheel, tending to neutralize any variation in the speed of the prime generator. As the nominal speed of the machine is less than 1,100 revolutions per minute, the structural strength is more than sufficient to meet all demands made by centrifugal force. Further than this, the mechanical stress is less when the magnets are excited than when the alternator is running without load, as the lines of magnetic force between the faces of opposing poles tend to counteract centrifugal force. In machines of larger size, as usual, the speed is less, that of the 150,000-watt dynamo being not more than 700 revolutions per minute.

The most interesting part of the alternator is the fixed armature, shown in Fig. 2. The vertical disk is occupied by flat armature-coils made of insulated copper ribbon wound on porcelain cores. The copper ribbon of each coil is re-enforced on either side with strong insulating material of the same thickness as the porcelain. One of these re-enforcements is grooved, and the other tongued. The coil, consisting thus of core, ribbon, and re-enforcements, has an angular width of 60 degrees. The upper part of each face of each coil is covered with an insulating plate five-sixteenths of an inch thick. The coil thus built up and insulated is set in German-silver holders, cut from turned rings, and held together by sunk-headed screws. Each terminal of the copper ribbon connects with a binding-post, as shown.

The six armature-coils thus mounted are carried in a German-silver frame consisting of two semicircles bolted together on the line of the vertical diameter. Into the slots of the frame slip the six mounted armature-coils, the tongue on the edge of the one engaging with the groove on the edge of the next. The coils thus thrust into the intense magnetic field constitute a disk nine-sixteenths of an inch in thickness, and with an opening in the centre through which passes the revolving shaft. As there is no magnetic metal in the armature, there are no local currents to waste the energy.

The several coils are insulated carefully; and the stationary armature, as a whole, is insulated from the bed-plate on which it rests. The coils are joined in series, the binding-posts adjacent to any radial line of division between the two coils constituting fixed terminals for the main line. There is no commutator, and there are no collecting brushes to take the alternating current from the rotating parts.

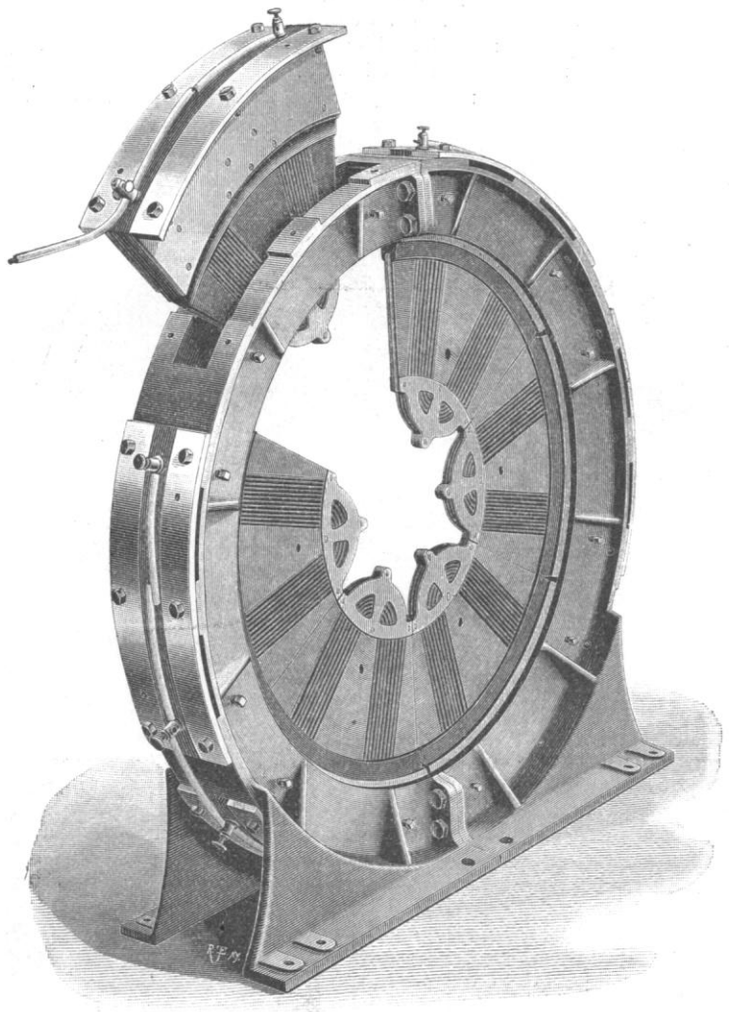


FIG. 2.

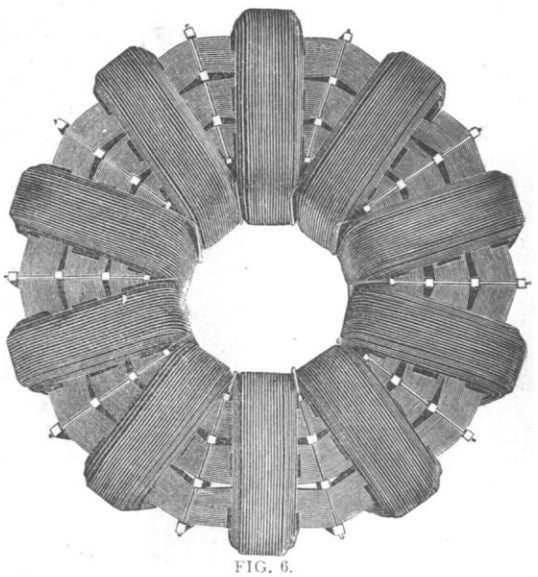


FIG. 6.

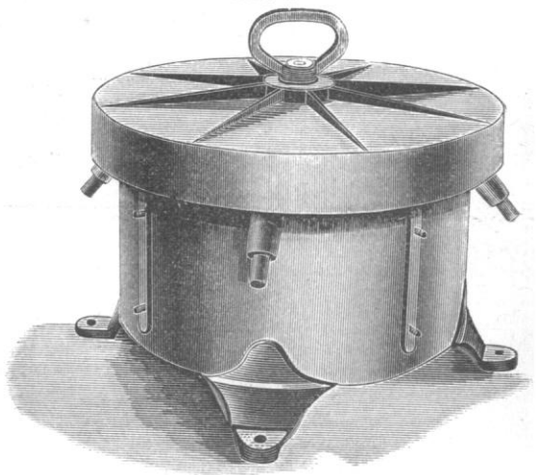


FIG. 8.

FIGS. 2, 6, AND 8. — BRUSH ALTERNATING SYSTEM.

The low resistance of the armature-coils is evident. It would seem impossible for one of them to burn out. None ever has burned out; but if one should, it may be removed, and a new one readily put in its place, in three minutes, or the injured coil may be shunted out of the circuit and the dynamo kept running with the other five until the time for shutting down. The coil section complete weighs only about 20 pounds. The whole armature may be removed by loosening the coupling-bolts, and sliding each half of the frame from between the field-magnets (Fig. 3).

In action, the 24 field-magnets of the alternator are excited by the direct current from a Brush dynamo of the well-known form. This exciting current is carried to the brushes that rest upon the two uncut insulating rings (shown at the left of Fig. 1), and thence

through the hollow shaft to the magnets. A rheostat (Fig. 4), worked by hand or automatically, is placed in the shunt circuit around the field-magnets of the exciter; so that perfect regulation is secured without re-adjustment of the brushes, or any necessity of handling the high-tension alternating current.

is less than ten per cent, as is shown in the curve, Fig. 5, which represents a diagram taken from one of the first machines. All this is accomplished without compound winding or artificial regulation of any kind, — a result which, it is claimed, has not been approached by any alternator with an iron core in its armature. All

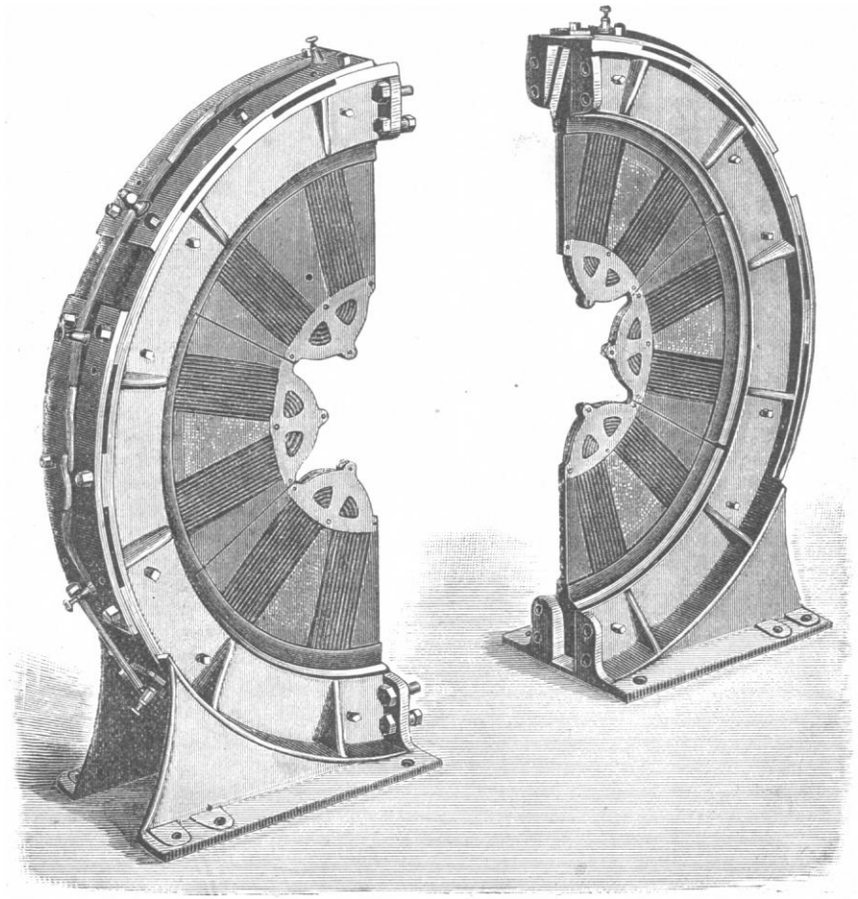


FIG. 3. — BRUSH ALTERNATING SYSTEM.

The Brush "coreless" alternator is built at present for an electro-motive force of 2,000 volts, although it would be easy to develop a much greater difference of potential. It is confidently expected that the necessity of long-distance transmission with a line of

the regulation needed is applied at the exciter, as already described. This results in a more even distribution of potential in the feeders and at the converter terminals, and a more even pressure at the terminals of the lamps beyond.

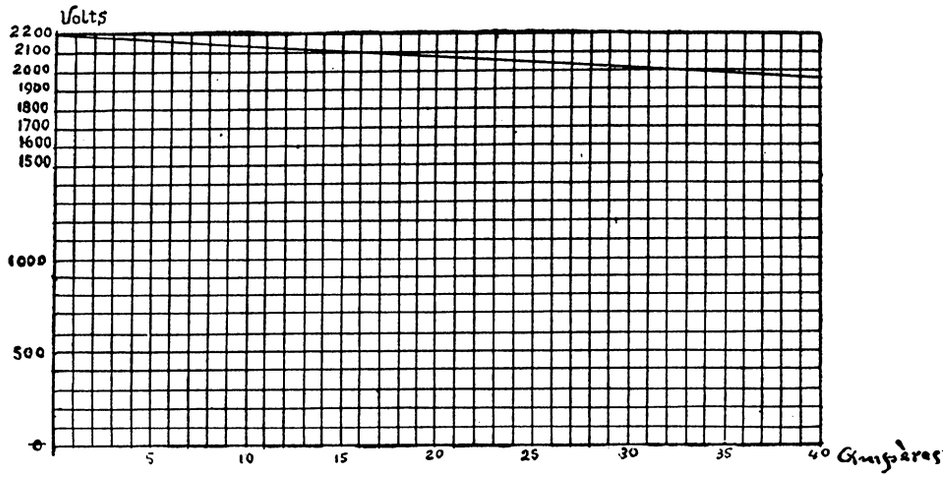


FIG. 5. — BRUSH ALTERNATING SYSTEM.

moderate cost will soon call for currents of higher tension, as economy of power as well as economy of copper point in this direction.

The fall of the potential in the machine from no load to full load

Though the high-tension current of the alternator is well adapted for economical carriage to distant points, it is not of the kind most desirable for introduction to the household, or for use in the lamp. Having brought electric energy from the place where it is devel-

oped to the place where it is to be used, the form given to it for economy of transportation may be changed so as to adapt it fully to the uses for which it is intended. High tension may be exchanged for greater current, volts for ampères. This transformation is accomplished by the converter shown in Fig. 6. In this converter, the core consists of a polygonal ring made of insulated iron wire, so wound as to leave several concentric air-spaces in the core. In the converters of the smaller sizes, the core is built up of

FIG. 4. — BRUSH ALTERNATING SYSTEM.

perforated thin iron plates (Fig. 7). In either case, the iron is so divided that the efficiency of the converter is little less with half than with full load. Upon each side of this core or iron ring is wound a single layer of heavy copper wire. The four or five single-layer coils carried by each half of the core are joined in series; and the two groups, borne by the two halves of the core, are joined in multiple, the whole constituting the secondary coil. The terminals of this secondary coil connect with the secondary main line running into houses and supplying current for the lamps. Most of the converters are wound so as to give a secondary current of

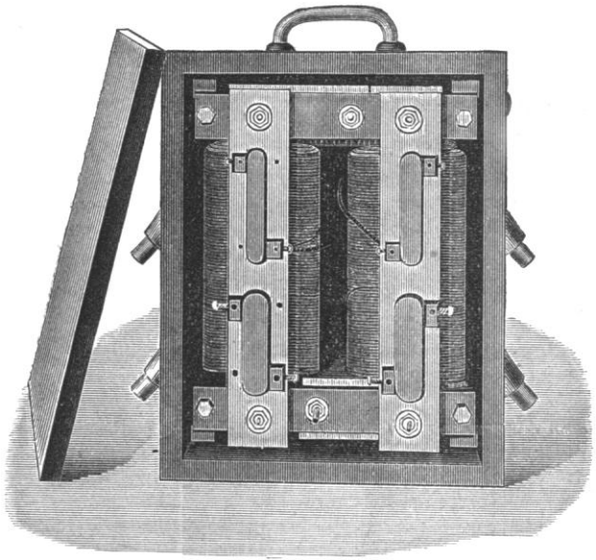


FIG. 7. — BRUSH ALTERNATING SYSTEM.

about 100 volts, but may instantly be connected to give 50 volts and twice as many ampères as before. They are made in sizes that supply each from 5 to 250 16-candle-power lamps, or more.

Between the fine iron wire of the core and the heavy copper wire of the superposed secondary coil, insulating pads one-eighth of an inch thick are placed at the corners of the core. Between these insulating corner-pieces are insulating air-spaces. Thus the copper and the iron are separated from each other at the corners of the core by their respective coverings and the insulating pads, and at all other points by their respective coverings and open air-spaces, the latter affording ample ventilation and facility of examination.

Over each of these single-layer parts of the secondary coil are bound a few layers of smaller copper wire to form a corresponding part of the primary coil. These corresponding parts of the secondary and primary coils are separated from each other by insulating pads at the corners and intervening air-spaces in the same manner and with the same advantages as previously described.

The ventilation of these converters is specially provided for, and the insulation resistance is exceedingly high. It is impossible to so overload the wire of the primary circuit as to force its current into the secondary circuit: in other words, the high-tension current cannot pass the converter. The converters are tested at the factory with double load, and, though no one has ever given out, overloading is made impossible by the use of safety-fuzes for the primary coils. These are extra long, and so mounted on slate or porcelain strips that they may be removed or replaced with the fingers merely, and without touching any metallic part of the converter.

The converter-coils, with safety-fuzes, etc., are placed in wind and weather proof cast-iron boxes of pleasing design (Fig. 8), and may be placed wherever most convenient; the governing

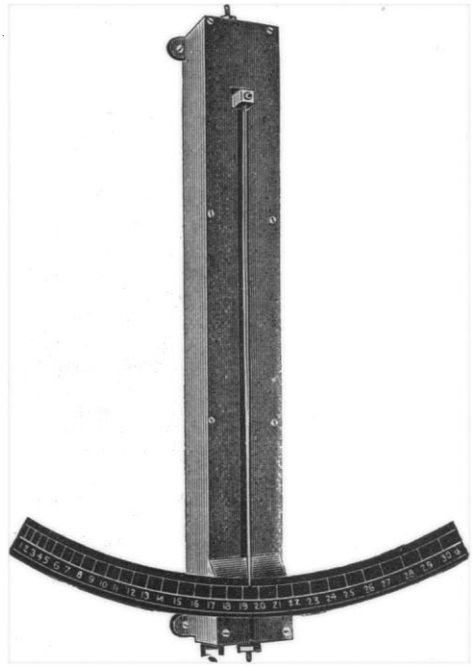


FIG. 9. — BRUSH ALTERNATING SYSTEM.

principle being to do as much work as possible with the less expensive primary wire, and to shorten the more costly secondary main. These converters are now made in sizes ranging from 2-lamp to 250-lamp capacity. With converters, as with dynamos, the larger sizes are the most economical. With a 100-volt converter fed by a 2,000-volt primary current, it is more easy and profitable to run a short secondary main to supply several consumers than to provide a converter for each consumer.

Fig. 9 represents the ammeter, which is placed in the main or feed circuit, wherever it is desirable to measure the strength of the current. It is a compensated expansion device, acting on the principle of one type of Brush arc lamp. It is free from any magnetic action, the simple compensating arrangement insuring the normal working of the apparatus at all temperatures. It is equally efficient with direct and with alternating currents.

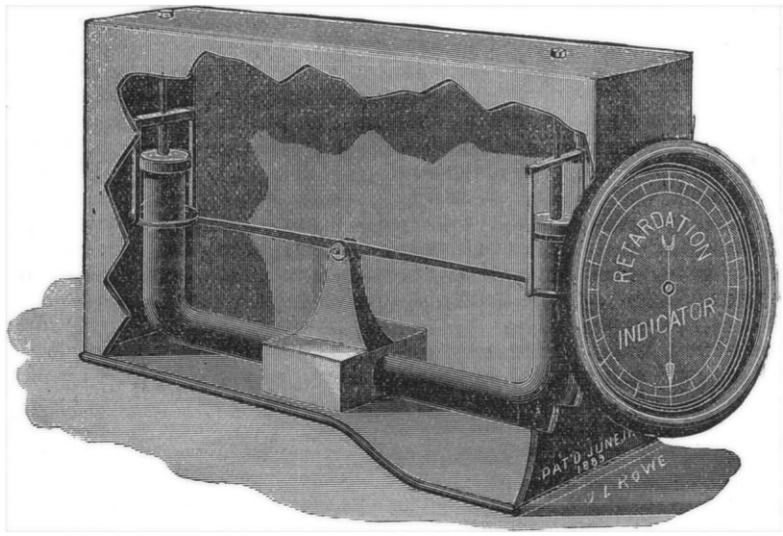
The alternating-current apparatus of the Brush Electric Company here described is based on the patents of Charles F. Brush and Gustav Pfannkuche, the latter having the supervision of this branch of the Brush Electric Company's business.

THE heat in Russia and other parts of northern Europe has been intense of late. The Central Observatory at St. Petersburg has not recorded such a high temperature at the same time of the year since 1774.

ARNOLD'S RETARDATION INDICATOR.

THE retardation indicator shown in the accompanying engraving is an apparatus intended to be placed in the cab of a locomotive, for indicating the relative measure of resistance exerted by the air-brakes when arresting the momentum of the train. By its use the person operating the brakes may be enabled to so regulate the steam or air pressure applied to the brakes as to prevent a too rapid stoppage of the train, and the consequent discomfort to the passengers.

The indicator consists of a tube, with upturned ends, arranged horizontally in the cab or car, the axis of the tube being parallel with the direction in which the train is to move. This tube contains mercury, which, as the train starts or stops, shows a difference of level in the upturned ends of the tube, governed by the rapidity of the starting or stopping, the change of momentum being proportional to the impulse producing it. Each end of the tube is provided with a freely moving piston, which rests upon the surface of the mercury. These pistons are attached to an arm which is pivoted in the centre, the pistons exactly balancing each other. Attached to an extension of this arm is a bevel-geared sector, which meshes into a pinion connected with the pointer on the dial-plate. When the train is at rest, or moving at uniform speed, the pointer remains at zero on the dial; but, when starting up or slowing down, the pointer moves around the dial, to the right or the left, a distance proportional to the rapidity of the starting or the stopping.



ARNOLD'S RETARDATION INDICATOR.

Among the advantages claimed for it are the following: it shows the engineer at any instant the effect of the brakes upon the wheels, and enables him to retard the train uniformly, regardless of the condition of the track or of the air-pressure; it economizes the air, and prevents an undue shock or strain on the brake-rigging or the car-body; and it enables the engineer to apply the brakes gradually, and with increasing effect, until the train is brought to rest. The indicator is manufactured by J. H. Reynolds of Troy, N.Y.

ELECTRICAL NEWS.

Incandescent Electric Lamp Filaments.

IN a recent communication to the Academy of Natural Sciences of Philadelphia, on the use of bamboo in incandescent electric lighting, Professor William P. Wilson states, that, for want of a homogeneous structure, the ordinary exogenous woods are not adapted to the construction of lamp-filaments. Such woods are made up of wood-cells of varying lengths and shapes in combination with a variety of ducts and vessels.

The walls of the wood-cells may be more or less thickened, the vessels and ducts may be larger or smaller, numerous or infrequent, according to the kind of wood examined. There are always enough of these vessels and ducts combined with the wood-cells in any stem to render the structure exceedingly heterogeneous. Most of these cells and vessels have their longer diameter parallel with the general direction of the stem. Groups of thin-walled, prismatic cells pass radially from the central portion of the stem to the circumference. These groups of cells are called medullary rays. It is impossible to cut a filament from any of these woods so that the medullary rays will not cross it many times at right angles to the ducts and long cells. The character of the cells forming these rays is so very different from the others in the filament, as to shape, direction, and thickness of the walls, that at the crossing points resistance is greatly increased, thus causing rapid burning and destruction at such points.

Such woods as hickory and rock-elm furnish the very best of our timbers. They are the toughest and most durable of our woods, but they do not make good filaments. The medullary rays are very numerous, and the walls of the cells composing them are greatly thickened. The long, pointed, thick-walled wood-cells do not follow a parallel course, but interlace with each other. This interlacing of the cells gives to these woods their toughness. It is the main characteristic, also, which renders them worthless when made into electric filaments. Upon carbonization of such filaments, the tension of the interlacing cells is relieved, and the tissues composing it become friable, and easily fall apart.

In the adult stem of the bamboo a combination of anatomical characters has brought about a result which makes it the most fitting material, so far as now known, for the electric filament. The nearly parallel fibro-vascular bundles grow more numerous as they approach the circumference of the stem, and, as is usual in similar stems, lose most, or sometimes all, of the woody elements, thus becoming pure bast. The parenchymatic tissue, which toward the centre of the stem may be composed of a layer of five or six cells between the bundles, decreases in amount near the circumference until but one layer of cells remains. The walls of the cells in this single layer often become so thickened, and at the same time compressed by the growth of the bast, that these bundles appear to make a solid zone of bast around the circumference of the stem. The bast-cells also continue to thicken their walls until they become, in the best specimens for the filament, completely filled and solid. It is from this zone of bast at the circumference of the stem that the filament is always taken. It is perhaps the nearest approach, in its continuity of structure and uniform character, to a metallic conductor, of any tissue which can be found in the vegetable kingdom.

Photographs of Lightning.

At a meeting of the Physical Society of London held June 22, and reported in *Nature*, Mr. A. W. Clayden presented a note on some photographs of lightning, and of "black" electric sparks. The lightning photographs, three in number, were obtained dur-

ing the storm on June 6. Two flashes, seen on one plate, show complicated and beautiful structure: one of them is a multiple flash, and flame-like appendages point upwards from every angle; the other is a broad ribbon, and, although the plate shows signs of movement, the displacement is not in a direction such as would produce a ribbon-like effect from a linear flash. The second plate shows four flashes, none of which are ribbon-like, though the camera had moved considerably. The third plate was exposed to six flashes, one of which was believed to pass down the middle of the plate; but, on development, only a triple flash in one corner of the plate was seen. Careful search, however, revealed the central flash as a dark one with a white core, and other dark flashes were subsequently found. The plate was very much over-exposed, and this suggested that black flashes might be due to a sort of cumulative action caused by the superposition of the glare from a white cloud upon the normal image of the flash. To test this, sparks from a Wimshurst machine were photographed, and, before development, the plates were exposed to diffused gaslight for a short time. The bright sparks yielded normal images with reversed margins, and the faint ones were completely reversed. Other experiments showed the reversal to spread inwards as the time of exposure to gaslight increased. Finally, reversal was effected by placing a white screen behind the spark, to represent a white cloud, the only illumination being that of the spark itself.

In the discussion which followed, Mr. W. N. Shaw exhibited a photograph taken during the same storm, which is particularly rich in dark flashes branching outwards from an intensely bright one. In some places the bright line has dark edges, and in one part a thin bright line runs along the middle of an otherwise dark portion of the flash. In answer to Mr. Inwards, Mr. Shaw said the plate was exposed about half a minute; and the former thought, that, under those conditions, the appearance of the plate did not contradict Mr. Clayden's hypothesis. Speaking of the same photograph, Professor Perry considered that Mr. Clayden's observations would explain the result, for a bright flash required more exposure to diffused light to reverse it than a faint one did. Professor Ramsay reminded the meeting that Professor Stokes's "oxides of nitrogen" explanation was still a possible one; and Mr. C. V. Burton asked whether they may be due to faint sparks cutting off light from brightly illuminated clouds, just as a gas-flame absorbs light from a brighter source. In reply, Mr. Clayden thought the "oxides of nitrogen" hypothesis improbable, and said his experiments did not enable him to answer Mr. Burton's question. As regards Mr. Shaw's plate, he believed the diffused light from the clouds would be sufficient to reverse the fainter tributary flashes, although it was insufficient to reverse the primary one. From data obtained when the ribbon-flash was taken, he had made some calculations which gave the height of the clouds about 1,000 yards, and the ribbon-flash 1,300 yards long and 100 yards wide.

PERMEABILITY OF IRON. — From experiments conducted during the last two years, J. T. Bottomley, F.R.S., finds that the permeability of iron can be enormously reduced by repeated heatings and coolings while undergoing magnetic cycles of small range.

AUTOMATIC ELECTRIC RAILWAY-LAMPS. — Mr. H. J. Dowsing, in a letter to the *Electrical Review* of July 12 (London), claims to have invented a lamp for train use. A penny is dropped into the apparatus, a handle half turned, and the light immediately shines forth; and without any arrangement of clockwork trains, springs, etc., the time is controlled and the light goes out at the end of half an hour. An advantage which perhaps could not be so easily managed by clockwork is, that one can arrange the apparatus to burn any time, from two minutes to say ten hours, by one half-turn of the handle.

HEALTH MATTERS.

Water-Supply of Paris.

THE Paris correspondent of the *Lancet*, writing in the issue for June 22, says that a great danger to visitors to Paris is due to the insufficiency of the water-supply. Paris is in a most unfortunate position. It cannot be said that the water-supply is bad. On the contrary, at immense cost, Paris has secured one of the best water-supplies enjoyed in any town of Europe. According to the last report, Paris was receiving 121,000 cubic metres of the Vannes water, 21,000 cubic metres derived from the Dhuis, and 5,000 cubic metres from the St. Maur springs, — in all, 147,000 cubic metres of pure and excellent spring-water. This, however, is not enough. The daily consumption is estimated at 158,000 cubic metres. The deficiency is not very great: still it is enough to compromise the whole town; for, when the store of good water is exhausted, the Seine water is provided, and this through the same channels and without warning. Thus, though a person may, as a rule, drink wholesome water, he will receive for a week or so, during the course of the year, water taken from the Seine, which is very likely to be contaminated. Again: a person may drink a glass of water in one quarter of Paris which is perfectly pure, while in another district he may, on the same day, get water that is certainly not free from the occasional presence of injurious organic matter. At the present moment, the supply of spring-water having reached a low ebb, the Seine water is turned on in four arrondissements. For twenty days these unfortunate districts are to receive only the Seine water; then three other arrondissements are to be served in the same way.

In the pavilion of the prefecture of the Seine, situated in the central court or garden of the exhibition, will be seen three glass tanks of water side by side. One receives the water of the Ourcq Canal, another of the Seine, and the third of the Vannes. The first two are more or less opaque, are of a green-yellowish tint, and vary more or less in aspect from day to day; but that which contains the water of the Vannes is always perfectly transparent, and never changes. Members of the Municipal Council have urged, so far in vain, that the water-supply should be increased. There are numerous projects, and recently a resolution was passed by the council, calling upon the legislative chambers to discuss at once the scheme for bringing the waters of the Avre to Paris.

That the Seine water may be dangerous will be obvious to all who are acquainted with the neighborhood of Paris. The intake for the supply is, of course, outside the town, and some little distance up the stream, but it is unpleasantly near the large manufactories of *poudrette*, or human guano. Also there are boats containing tanks which are filled with the contents of cesspools, and the manure is thus conveyed up the river to the works. A few years ago some scavengers, in their impatience to finish their day's toil, instead of conveying all the soil the barges contained to the works, simply threw a considerable portion over into the river. Fortunately this was discovered; and now there is a service of inspection organized both day and night, and careful watch is kept that these tank-barges should not again contaminate the water. But there are other causes of pollution, and it is an undeniable fact that many outbreaks of typhoid-fever in Paris have occurred about a fortnight after the substitution of Seine water for the usual and pure supply of water from the Vannes or the Dhuis. The question of water-supply is a very serious problem, which the French authorities should lose no time in settling.

THE NAPHTHA HABIT. — The *Medical Standard* calls attention to the growth of the "naphtha habit" among the female employees of rubber-factories. The inhalation of naphtha-fumes produces a peculiarly agreeable inebriation. Naphtha is used to clean rubbers, and is kept in large boilers, to the valve of which the female employees obtain access, and breathe the fumes. The habit was introduced from Germany, and is chiefly found in the New England States.

NOTES AND NEWS.

THROUGH the efforts of Dr. Filip Trybom, the Swedish Oyster-Culture Society is attempting to acclimatize the American oyster, imported from Connecticut, in several places along the coast of the province of Bohus. The young oysters seem to thrive well.

— The Victorian Government statist has published a return of the estimated population of the Australian colonies for 1888. In Victoria the estimated population on Dec. 31 last was 1,090,869; New South Wales, 1,085,356; Queensland, 387,463; South Australia, 313,065; western Australia, 42,137; Tasmania, 146,149; New Zealand, 607,380; making a total of 3,672,419 for the whole

of the colonies. During the year the population of the Australian colonies increased 120,668: the increase in Victoria being 54,750; New South Wales, 42,437; Queensland, 20,523; South Australia, 4,381; western Australia, 351; Tasmania, 3,671; New Zealand, 4,019.

— The *rôle* played by vegetation in determining the character of land surface is well shown in the so-called "banana-holes," so abundant in New Providence and other of the Bahama Islands, — holes varying in size from that of a pint cup to that of a large cistern. They are suggestive of pot-holes, but can have no such origin, and are evidently not cut out by the waves at any previous period of subsidence. Professor Charles S. Dolley, who recently examined these holes, could account for their formation in but one way, and that is through the action of decaying vegetable matter. Each of these holes contains large quantities of leaves and other vegetable substances, which, being kept wet by the heavy rains and by the fresh water elevated by each rising tide (almost all wells have a regular ebb and flow in these porous islands), undergo fermentative changes, by the products of which the soft calcareous rock is dissolved, and leaches away.

— *L'Economiste Française* says that on the 31st of December, 1887, the total length of railways worked in Europe amounted to 207,939 kilometres (the kilometre being equivalent to .621 of a mile), as compared with 201,468 kilometres in the preceding year. The increase in 1887 was therefore 6,471 kilometres, or at the rate of 3.21 per cent. The openings to traffic of the new lines which took place in 1887 increased by 2.67 per cent the length of the French system, while the percentage increase was 3.18 in Germany, 5.59 in Austria-Hungary, 3.71 in Belgium, 1.03 only in the United Kingdom, 3.92 in Italy, 2.96 in Russia. Roumanian lines increased 21.25 per cent in 1887. The extent of French railway lines opened in the course of 1887 represents 13.77 per cent of the total length of line opened in the whole of Europe during the same period. The participation of Germany in the increase of the European railway system is 18.87 per cent; Austria, 20.21 per cent; Belgium, 2.60 per cent; Great Britain and Ireland, 5 per cent; Italy, 6.76 per cent; and Russia, 12.67 per cent.

— Professor Edward H. Griffin of Williams College has accepted in Johns Hopkins University the office of dean, and professor of the history of philosophy, and he will enter upon his new duties at the beginning of the next session. He was graduated at Williams College in 1862, and subsequently pursued the study of theology in Princeton and in New York. Since 1872 he has been a professor in Williams College, having recently occupied the chair of intellectual and moral philosophy which bears the name of Mark Hopkins. Professor Griffin received the honorary degree of D.D. from Amherst in 1880, and of LL.D. from Princeton in 1888.

— It appears, according to *Nature*, that the meteoric stone found in Scania, and acquired by Baron Nordenskiöld for the National Museum at Stockholm, fell on April 6, and that its fall was accompanied by a red flash like lightning and a thunder-like detonation. It weighs eleven kilograms, and had made a hole thirty centimetres in depth; but, having recoiled, it lay on the level ground at the edge of the hole. The color is grayish black, and the fracture grayish white. From a hasty analysis made by Herr A. Wingardh of Helsingborg, the chief mass appears to consist of manganese, in which are yellow and gray particles of metal. The meteorite seems to have been in a red-hot state, being covered with a glazed coating of fused metal half a millimetre in thickness.

— The international congress which met in Paris in 1887 to make arrangements for the preparation of a photographic chart of the heavens expressed a wish that a similar congress might meet for the discussion of questions relating to celestial photography in general. M. Janssen and Mr. Common were asked to take such steps as might be necessary for the attainment of this object; and afterwards, by a ministerial decision at Paris, an organizing committee, with M. Janssen as president, was appointed. The arrangements have now been completed, and the congress will be held in Paris from Aug. 22 to Sept. 3. The aim of the congress will be to determine the methods which are most suitable for each branch of celestial photography, and the means by which the results obtained by these methods can be most effectually published and preserved.

— W. F. C. Hasson, a graduate of the United States Naval Academy, and now an assistant engineer of the United States Navy, has been detailed by the United States Navy Department to give instruction for the next three years in mechanics and engineering at Johns Hopkins University, and has already entered upon the duties of his new post.

— W. J. Stillman writes to *Nature*, June 27, from Canea, Crete, that he has just witnessed a curious case of bird instinct which seems worth recording. A gardener living at Zukaleriá, three miles from Canea, caught in his garden a young but fully fledged sparrow, which he brought to the house of a friend with whom the writer was staying in Canea, leaving home early in the morning. He presented the bird to one of the children in the house, and it was put in a cage and hung at the window, where it seemed likely to be contented, losing its fright after a few hours. Late in the afternoon an old bird was noticed fluttering about the cage, apparently trying to get at the little one; and the young bird, on its appearance, became frantic to get out to the old one. It was evidently the mother of the young one, as the recognition was too cordial to have been owing to the interest of a strange bird; and when Mr. Stillman's daughter opened the cage, as she did after a little, they both flew off rapidly in the direction of Zukaleriá. It is impossible that the old bird should have followed the gardener, as it would have been seen by them earlier in the day.

— The Botanical Society of France announces the following programme of the forthcoming botanical congress to be held in Paris: Tuesday, Aug. 20, opening sitting of the congress at 2 P.M., at the hotel of the Horticultural Society, 84 Rue de Grenelle; reception of foreign members at 8.30 P.M. Wednesday, Aug. 21, sitting at 9 A.M., devoted to the consideration of the first question, on the utility of an agreement between the different botanical societies and museums, for the purpose of drawing up charts of the distribution of species and genera of plants on the globe; and other communications, if time allows. Thursday, Aug. 22, excursion in the neighborhood of Paris. Friday, Aug. 23, sitting at 9 A.M., devoted to the consideration of the second question, on the characters furnished by anatomy for classification, and other communications if time allows; in the afternoon a visit to the botanical collections and laboratories of the Museum of Natural History, and of the other large scientific establishments in Paris. Saturday, Aug. 24, sitting at 9 A.M., miscellaneous contributions; in the afternoon a visit to the exhibition. Sunday, Aug. 25, banquet to the foreign botanists. During the following week several botanical excursions will also be arranged. Special arrangements with regard to railway-fares will be made in favor of botanists announcing their intention to be present to M. P. Maury, the secretary to the committee of organization, 84 Rue de Grenelle, before July 25.

— The sixty-second meeting of German naturalists and physicians will be held at Heidelberg from Sept. 17 to Sept. 23. One whole day will be devoted to excursions in the neighborhood, and on the evening of Sept. 23 the Castle of Heidelberg will be brilliantly illuminated.

— Satisfactory progress is being made with the preliminary arrangements in connection with the Electrical Engineering and Mechanical Inventions Exhibition, which is to be held in Edinburgh next year to commemorate the opening of the Forth Bridge. Support has been promised from this country, and some of the exhibits in the Paris Exhibition are to be transferred to Edinburgh.

— In 1887–88 the courses in astronomy at Johns Hopkins were so extended as to justify its being chosen as a principal subject by candidates for the degree of doctor of philosophy. A small observatory has been erected, and is fitted up with a meridian circle by Fauth & Co., a portable transit instrument by Troughton, a clock, a chronograph, and other subsidiary apparatus. In the dome of the physical laboratory is mounted an equatorial of 9½ inches aperture, so fitted that the student can learn to make the usual determinations with the largest instruments of that class. The work in astronomy consists in a study of the history and practice of the subject, supplemented by instruction in the use of the instruments, and exercises in astronomical computation. During the year 1889–90 the courses are intended to cover a wider range of individual subjects than usual.

— Dr. Henry M. Hurd, now superintendent of the State Hospital for the Insane at Pontiac, Mich., in the neighborhood of Detroit, has been appointed superintendent of the Johns Hopkins Hospital. His life has been devoted to hospital service, and he has acquired distinction as an administrator, and also as a writer. He was graduated in arts and in medicine at the University of Michigan, and has twice been called by his *alma mater* to a professorship of medicine. He has already visited Baltimore, and will permanently assume his new responsibilities on the first of August next.

— Messrs. Dubois and François of Seraing, Belgium, have devised a system of drilling and breaking down rock and coal, to which they have given the name of "Bosseyage Mécanique." This system consists in first boring a hole, and then in breaking down the rock by a compound wedge formed of two half round outer portions, and a central tongue or arrow. The boring or jumping tool is taken off the drill spindle, and is replaced by a tup, by which the central wedge is driven forward by repeated blows until the rock gives way, and a part of it falls down.

— It is stated, apparently on good authority, that the money taken at the Eiffel Tower elevators between May 15 and July 2 has amounted to 1,298,944 francs, or nearly $260,000. If these figures be correct (and there seems no reason to doubt them), the Eiffel Tower will prove as great a success as every other part of this wonderful centennial celebration.

— Mr. and Mrs. Lawrence Turnbull of Baltimore have founded in the Johns Hopkins University a lectureship of poetry in memory of their deceased son, Percy Graeme, who was born May 28, 1878, and died Feb. 12, 1887. The lectureship will bear the name of "The Percy Turnbull Memorial Lectureship." The income of the foundation is one thousand dollars per annum, and the first course of lectures may be expected in the session of 1889–90.

— Mr. Eugene Levering of Baltimore has offered to the Johns Hopkins University the sum of twenty thousand dollars for the construction of a building for the uses of the Young Men's Christian Association, and for the promotion in other ways of the interests of that society.

— On the motion of Lord Charles Beresford, a parliamentary return has been prepared, giving particulars of all breech-loading iron and steel guns that have failed after delivery for service. The return states that no guns have burst, or "blown out," or rendered the breech-piece useless, and no gun has been rendered useless by erosion, though between Dec. 31, 1885, and March 19, 1888, nine guns have had to be relined. The number of rounds fired from these nine before relining became necessary varied in the different instances from 114 to 1,480. Six guns were injured from other causes, and required retubing or relining. Only one Elswick gun has failed during the period covered by the report, the rest being all of Woolwich manufacture.

— Among the recent appointments of graduates of Johns Hopkins University we have learned of the following: William J. Alexander (fellow 1881–83, Ph.D. 1883), professor of English, University of Toronto; John C. Adair (graduate student 1887–89), professor of chemistry, Tarkio College, Missouri; Charles M. Andrews (fellow 1888–89, Ph.D. 1889), associate professor of history, Bryn Mawr College; Louis Bevier (fellow 1879–81, Ph.D. 1881), adjunct professor of modern languages, Rutgers College; Frank W. Blackmar (fellow 1888–89, Ph.D. 1889), professor of history and sociology, University of Kansas; Oskar Bolza (reader in mathematics, 1888–89), associate in mathematics, Clark University; Benjamin L. Bowen (Ph.D. 1888), associate professor of French and German, Ohio University; William M. Burton (fellow 1888–89, Ph.D. 1889), chemist, Standard Oil Company, Cleveland, O.; Morgan Callaway, jun. (fellow 1888–89, Ph.D. 1889), professor of English, South-Western University, Georgetown, Tex.; John Daniel (graduate student 1886–88), instructor in physics, Vanderbilt University; Paul J. Dashiell (A.B. 1887), instructor in organic chemistry, Lehigh University; Henry H. Donaldson (fellow 1881–83, Ph.D. 1885, associate and instructor 1885–89), assistant professor of neurology, Clark University; Charles G. Dunlap (graduate student 1883–86), associate professor of English, University of Kansas; Alfred Emerson (fellow 1882–84), professor of Greek, Lake Forest University, Illinois; Joseph A. Fontaine (Ph.D. 1886), professor of modern languages, University of Mississippi; Samuel Garner (Ph.D. 1881), assistant professor of modern languages, United States Naval Academy; Richmond Harding (Ph.D. 1887), professor of Greek, Davidson College, North Carolina; James T. Hatfield (fellow 1888–89), professor of German, North-Western University, Illinois; Clifton F. Hodge (fellow 1888–89, Ph.D. 1889), fellow in psychology, Clark University; James G. Hume (graduate student 1887–88), Rogers fellow in ethics, Harvard University; H. C. G. von Jagemann (fellow 1883–84, Ph.D. 1884), assistant professor of German, Harvard University; David J. Lingle (graduate student 1887–89), assistant professor of biology, Tulane University; Warren P. Lombard (graduate student 1886–87), assistant professor of physiology, Clark University; James L. Love (graduate student 1884–85), Morgan fellow in mathematics, Harvard University; Thomas McCabe (fellow 1887–88, Ph.D. 1888), professor of modern literatures and director of German department, Indiana University; Archibald MacMechan (fellow 1887–88, Ph.D. 1889), professor of the English language and literature, Dalhousie College, Nova Scotia; Franklin P. Mall (fellow 1886–88, assistant in pathology 1888–89), adjunct professor of anatomy, Clark University; Philippe B. Marcou (instructor in French 1880–83), instructor in French, University of Michigan; John E. Matzke (Ph.D. 1888), collegiate professor of French, Bowdoin College; Colyer Meriwether (A.B. 1886), instructor in the English language and literature, Second Higher Middle School, Sendai, Japan; Chase Palmer (A.B. 1879, fellow 1880–82, Ph.D. 1882), professor of chemistry, Wabash College, Indiana; Mansfield T. Peed (graduate student 1883–85 and 1887–89), professor of mathematics, Emory College, Georgia; Edmund C. Sanford (fellow 1887–88, Ph.D. 1888), instructor in psychology, Clark University; Charles L. Smith (fellow 1887–88, Ph.D. 1889), instructor in history, Johns Hopkins University; Kirby W. Smith (Ph.D. 1889), instructor in Latin, Johns Hopkins University; Henry N. Stokes (fellow 1881–83, Ph.D. 1884), chemist, United States Geological Survey, Washington, D.C.; John N. Swan (graduate student 1888–89), professor of chemistry, Westminster College, Pennsylvania; W. Scott Thomas (A.B. 1889), professor of Greek and Latin, Chaffee College, California; Frederick J. Turner (graduate student 1888–89), professor of American history, University of Wisconsin; Amos G. Warner (fellow 1886–87, Ph.D. 1888), professor of political economy, University of Nebraska; John R. Wightman (fellow 1886–87, Ph.D. 1888), professor of French, Iowa College; Lucius E. Williams (graduate student 1885–89), assistant professor of chemistry, Swarthmore College.

— The simple and successful method by which a high chimney was recently overthrown is described by an exchange. The stack was one hundred feet high by ten feet square, and was on the Griswold Mills property, New Bedford, Mass. It was undermined by knocking out the bricks on the west and north sides, and shored up by planks placed in the apertures. These planks were liberally covered with tar and kerosene. When the time arrived for felling the chimney, they were fired. As they became sufficiently burned to cease to support the chimney, the mass settled out of the perpendicular to the north, and then cracked and fell with a crash to the ground. The bricks at the top were scattered over quite an area, while the iron coping was broken in quite a number of pieces. Along the length of the chimney to the height of sixty or seventy feet, masses of brick for a length of two feet or more clung together, and did not break up.

— An interesting series of experiments have been conducted, says *Building*, by the Dutch state railways, for the purpose of ascertaining exactly the relative resistance of various pigments to atmospheric changes and to the corrosive action of sea-water. The results have proved that the red-lead paints are less affected by atmospheric influence than those which are composed of the brown oxides of iron, on account of their adhering more closely to the metal, and of their possession of greater elasticity. It was also discovered that any sort of paint afforded an increased protection if the plates were pickled in hydrochloric acid before its application. The prevention of corrosion by salt water was found to be possible by the admixture of the oxide of some electro-positive metal, such as caustic lime and soda; but the efficiency of such a

covering was destroyed when its alkaline properties had been neutralized by the absorption of carbonic acid. Magnesia, however, was proved to be most serviceable, seeing that it does not absorb carbonic acid; and not only does it protect the iron from galvanic action, but it also does not affect the anti-fouling qualities of the paint.

— We have received the "Annual Report of the Board of Education and the Superintendent of Public Instruction of New Jersey" for the year ending Aug. 31, 1888. The report of the board occupies but a single page, and is of no general interest, while that of the State superintendent is mainly statistical. The State has increased its expenditure for schools of late, the increase for the year reported over the previous year being $450,000; and all the documents before us show that the authorities are alive to the need of educational improvement. It is not many years since the schools of the State were first graded, and the results of the change are reported as gratifying. Manual training has been introduced in a few places, but sufficient time has not yet elapsed to determine its real value. The reports of the county and city superintendents form the largest and most interesting part of the volume before us, but we have not space to particularize any of them. They detail the various methods employed in the different localities, with suggestions on various points. The report contains a large amount of statistical matter conveniently classified and arranged.

— The official returns of the last vintage of France show a sensible improvement over that of the previous year. It produced, says the *Journal of the Society of Arts*, 30,102,151 hectolitres of wine, being an increase of 5,768,867 hectolitres over 1887, and a diminution of 1,601,000 hectolitres only on comparison with the average production of the previous ten years. There were in 1888 1,843,580 hectares under vines. There is an augmentation of production in 37 departments, and a decrease in 40 departments. It is in the southern districts that the improvement is the most marked, while the regions of the east and west are most unfavorable. The departments of the south, which were the first attacked by the phylloxera, have been also the first to reconstitute their vineyards by the introduction of American stocks. These efforts have been in general successful, and in a short time it is hoped this region may regain its former importance. The mildew has in most of these departments been combated by the employment of sulphate of copper. The abundant rains during a portion of the summer, and the fine weather which followed in September, contributed to the development of the grapes, and the gathering was effected in excellent conditions. On the contrary, in the colder regions, the persistent rains of summer checked the ripening of the grapes, and retarded the vintage until the approach of frost. The wine-growers had recourse, as in preceding years, to the employment of sugar to improve the quality and increase the produce of their wines. No less than 36,633 tons of sugar were used for this purpose in 1888. Larger quantities of foreign wines were also imported to meet the demand for mixing. The imports were, from Spain, 7,008,000 hectolitres; Italy, 1,082,305 hectolitres; and Algeria, 1,089,000 hectolitres. The deficiency in the production was also made up by the manufacture of wines from the marc with sugar added, and from dry imported raisins. Of the former, 2,388,000 hectolitres were made; and of the latter, 2,220,000 hectolitres. The production of wine in Algeria is largely on the increase. The quantity made in 1888 was 2,728,373 hectolitres, against 1,902,457 in 1887. There are over 88,326 hectares under culture with vines in Algeria.

— On the evening of Jan. 31 last, about 9 o'clock, says *Nature*, the self-recording barometer at the Deutsche Seewarte showed a sudden dip of about .04 of an inch, with a corresponding jump upwards a few minutes afterwards; and in the course of a day or two it was found that the barographs at other stations exhibited a similar phenomenon. Although the disturbance cannot be compared in any way to the air-wave caused by the Krakatoa eruption, yet the rapidity of its translation proved it to be a noteworthy meteorological phenomenon, and its behavior over central Europe is discussed in an article contributed to the *Annalen der Hydrographie und maritimen Meteorologie* for June, by Dr. E. Herrmann of the Deutsche Seewarte. The disturbance is traced from Keitum (latitude 54° 54′), where it occurred at 7h. 50 m. P.M., Berlin time, on Jan. 31, to Pola (latitude 49° 42′), which it reached at 4h. 38m. A.M. on Feb. 1, having travelled at the rate of about 71 miles per hour. In an easterly and westerly direction the disturbance seems to have been confined to narrow limits. The barometer was high over southern Europe (30.5 inches), with minima (28.7 inches) over northern Finland, and between Iceland and Norway. There was no earthquake in Europe at the time, and the cause of the phenomenon remains at present unexplained.

— During the year 1886 the masonry and iron-work of the Madrid and Baudin bridges at Paris, says *Engineering*, were thoroughly cleansed by the process of M. de Liebhaber. These processes, chemical in their nature, were at first applied to the cleaning of limestones, but in these bridges materials of a different nature were dealt with. The surfaces to be cleansed are submitted to the action of a jet of mixed (dilute) hydrochloric and sulphuric acids, and left for two or three hours, when they are brushed, and finally washed with a water-jet. In the case of limestone, the hydrochloric acid unites with the calcium, forming chloride of lime, which is then decomposed by the sulphuric acid, forming a calcium sulphate; this being precipitated on the face of the stone, and containing all the impurities, which are then removed by the action of the brush and water-jet. In many cases this treatment will not succeed unless the stone is previously prepared, as the masonry becomes coated with a deposit of impurities contained in the atmosphere, which prevents the acids reaching the stones. In this case, before applying the acids, the stone is covered with a paste, consisting of a mixture of carbonate of soda and calcium hydrate, which is called "tolugene." It is spread over the masonry to a thickness of from one-half of a millimetre to one millimetre, and left there for from three-quarters of an hour to an hour, when the excess is washed down and brushed off, and the acids applied as described. In cleaning iron-work, the "tolugene" alone is used. It is spread over the work either with a trowel or brush, and in the course of an hour or so will have united with all the oil of the paint, leaving the red lead on the work in the form of a powder, which can be easily washed off with a jet of water. In cleansing brick, the work is first painted with a solution of ammonium fluoride, and this immediately afterward is treated with a jet of concentrated sulphuric acid, which liberates hydrofluoric acid; and this attacks the silicates, depriving them of their silica. The whole surface is afterward thoroughly washed with water.

— Reaumur, more than one hundred and fifty years ago, made quite extensive researches on clothes-moths; and, observing that they never attacked the wool and hair on living animals, he inferred that the natural odor of the wool, or of the oily matter in it, was distasteful to them. He therefore rubbed various garments with the wool of fresh pelts, and also wet other garments with the water in which wool had been washed, and found that they were never attacked by moths. He also experimented with tobacco-smoke and the odors of spirits of turpentine, and found that both of these were destructive to the moths; but it was necessary to close the rooms very tightly, and keep the fumes very dense in them for twenty-four hours, to obtain satisfactory results. Mr. C. H. Fernald (Bulletin No. 5 of the Hatch Experiment Station of the Massachusetts Agricultural College) has always found that any material subject to the attacks of moths may be preserved from them if packed away with sprigs of cedar between the folds. The odor of cedar is so disagreeable to them that they will not deposit their eggs where this odor is at all strong. Chests of cedar, or closets finished in the same wood, will protect clothing from moths as long as the odor is strong; but this is lost with age, and then they are no protection. It must be remembered that the odor of cedar, camphor, etc., only prevents the moth from laying her eggs on the fabrics; but if the eggs are laid before the garments are packed away with cedar, etc., the odor will not prevent the hatching of the eggs nor the destructive work of the larvæ afterwards. Clothing may also be protected from moths by packing it in bags made of either stout paper or cotton cloth, if made perfectly tight, but this must be done before the moths appear on the wing in the spring.

— Professor Edward S. Morse of Salem, Mass., has received notice of his election as corresponding member of the Berlin Society of Ethnology, Anthropology, and Archæology, accompanied by the society's diploma.

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada..... .....$3.50 a year.

Great Britain and Europe..... 4.50 a year.

Science Club-rates for the United States and Canada (in one remittance):

1 subscription	1 year.....	$	3.50
2 "	1 year.....		6.00
3 "	1 year.....		8.00
4 "	1 year.....		10.00

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VOL. XIV. NEW YORK, JULY 26, 1889. No. 338.

CONTENTS:

THE TWO EVENTS of scientific interest in New York at this time are the judicial investigation into the possibility of killing a human being by electricity without inflicting torture, the death to be instantaneous, and the progress of the arrangements for the world's fair to be held here in 1892. At the electrical hearing, all shades of opinion have been expressed by those called upon to testify. By some it is maintained that death is by no means sure to follow the application of currents of high potential, that the action of the electricity is liable to be erratic, and that the attempt to put to death by electricity the criminal now under sentence may lead to unlawful torture. By others, including Mr. Edison, it is testified that death will be sure and painless on applying the strong electric currents proposed. The exhibition plans have progressed to the stage of a meeting of prominent citizens at the mayor's office, for a discussion of preliminaries. The daily papers of this city, as well as many of the more prominent ones of other cities, have taken up the subject energetically, and appear to be unanimously in favor of the project. One or two of the larger Western cities seem to think that the proper place for such an exhibition would be at one of the great cities of the West, somewhere nearer the centre of the continent than New York; but the general consensus of opinion seems to be that the metropolis of the continent is the place at which to fitly celebrate the four hundredth anniversary of that continent's discovery.

ANTS.

IN the second bulletin issued by the Hatch Experiment Station of the Massachusetts Agricultural College, an account was given of experiments made for the destruction of ants in lawns and walks, but no methods were given for those that find their way into houses, and become an intolerable nuisance because of their desire for sugar and other sweets. These are more frequently the small species, but what they lack in size they usually make up for in numbers. Mr. C. H. Fernald is inclined to the opinion that they enter the houses and discover the coveted articles by chance; that their scouts, in exploring, find these articles, not by keen sight or smell, but by mere accident. When one has found some choice dainty, she (these wingless workers are undeveloped females, not neuters as some have supposed) sips her fill, and at once starts for home, where by some means she communicates the information of the locality of untold treasures to others, which return with her; and they, in turn, appear to spread the information on their return home; and soon the throngs that come and go are sufficient to disturb the most amiable of housekeepers. Various remedies have been suggested, one of which is to draw a chalk-mark on the floor around the sugar-barrels or other articles to be protected from them. It is undoubtedly true that ants travel in a regular beaten track, as it were, by the sense of smell; and, if this be removed from the ground over which they travel, they are at a loss, and often wander around for some time before they find the trail again. They may be thrown off the trail by drawing a chalk-mark or even the finger across it. This is only a temporary protection, however; for sooner or later they will find their way across, and then travel goes on as uninterruptedly as before.

It has been recommended to sprinkle sugar into a sponge and place it in their path, and, as it fills up with ants several times a day, immerse it in hot water to kill those adhering to it. This will undoubtedly prove successful if carefully followed up for some time; but, when we remember that the females are constantly laying eggs to produce workers which will take the places of those already destroyed, the task seems almost hopeless.

There can be no doubt that a better method would be to follow the ants carefully, and discover, if possible, where their nest is, and then destroy the entire community by making one or more holes down through the nest, and then pouring in a teaspoonful of bisulphide of carbon, carefully stamping down the ground afterwards to close the holes. The fumes of this substance will penetrate the nest in all directions, and destroy the entire community.

COLIC OF HORSES.

BULLETIN No. 2, Vol. II., of the Ohio Agricultural Experiment Station, is a comprehensive treatise on colic of horses, by Dr. H. J. Detmers, the veterinarian of the station.

It begins with a brief introduction, and a definition of what is understood by the term "colic," showing that the same is applied, not to a single disease, but to quite a number of morbid processes which have their seat in the digestive canal, and produce violent manifestations of pain. It then dwells at length on the various causes, and not only explains their action, or their effect upon the animal organism, but also draws attention to formerly overlooked facts, which throw light upon the origin of many cases of colic and the morbid processes of the same, which cannot be accounted for in any other way. It fully and comprehensively describes the symptoms, gives all the data necessary for the diagnosis and prognosis, and finally, in plain language, maps out a rational treatment, which is simple enough to be understood by everybody, and easy enough of application to be executed by any intelligent person. One plate illustrating the cause of certain morbid changes peculiar to horses and mules, and predisposing the same to the most frequent of these diseases, usually called colic, accompanies the treatise.

In the "Fifth Annual Report of the Ohio Agricultural Experiment Station" for 1886 (pp. 296–303), Dr. Detmers published a brief article on the causes of colic of horses. He then stated that his observations had confirmed Professor Bollinger's assertion that nearly every aged horse has an aneurism (a soft, pulsating tumor in an artery) in the anterior mesenteric artery, that such an aneurism is produced by the presence of a small worm (*Sclerostomum*

equinum) belonging to the family of *Strongylidæ*, and that in many, perhaps in a majority of cases, the existence of such an aneurism must be considered, if not the sole, at any rate the principal, cause of colic.

Although not much that is really new can be added to what was said in the annual report of 1886, and although no important discoveries have since been made, the simple fact that since that report was published such an aneurism has been found in every one of the sixteen horses that have been killed for anatomical purposes in the Veterinary College, or Veterinary Department of the Ohio State University, and that said aneurism was found not only in old horses, but also in young horses and in mules, will more than corroborate what was said two years ago, and be of interest to science, and of practical value to the farmer and horse-owner. As to the occurrence of the aneurism in young horses, Dr. Detmers states, that, among the sixteen horses and mules killed for anatomical purposes since the publication of the fifth annual report, were two young horses (one last year, and one this winter) which were each less than two years old, consequently mere colts, and that both had big aneurisms containing quite a large number of worms.

As colic is one of the most frequent diseases of horses, which, notwithstanding its frequent occurrence, is but little understood even by the majority of veterinarians, and consequently a disease which is seldom rationally treated, and perhaps oftener than any other a subject of quackery of the grossest kind; further, as it causes every year great losses, partially due to its often dangerous character, and partially to irrational treatment, — this brief treatise on colic, showing the causal connection between the aneurism and the morbid process, explaining its true causes, describing the symptoms, etc., giving a rational treatment, and pointing out the means of prevention, will be appreciated by farmers and horse-owners.

As to colic, it will, on the whole, be easier to ward off or to prevent the exciting than the predisposing causes. A prevention of the principal and most frequent exciting causes will be effected if the horse is always regularly fed; if the food is sound, wholesome, and digestible; if feeding a heavy meal immediately before and immediately after severe exercise is avoided; if no food that has a tendency to ferment, or that is rich in alkalies, is given; if the feeding of new grain and of new hay that has not yet passed through the so-called "sweating process" is avoided, or, where that cannot be done, if such new hay and new grain are fed only in small quantities, and then with a small pinch of salt added to each meal; if no icy food, or food covered with hoar-frost, is allowed to be eaten; if no ice-cold water is given to drink, or, when it cannot be avoided, only in small quantities, and never when the horse is perspiring or has an empty stomach; and, finally, if meal or bran that may be used as food is never given until it has been thoroughly moistened.

The principal predisposing cause, according to Dr. Detmers, — the aneurism in the anterior mesenteric artery, — can be warded off by preventing the worm-brood of *Sclerostomum equinum* from entering the digestive canal of the horse; but this, it seems, can only be accomplished if the horse is never allowed to drink any water but what is positively free from the worm-brood. That this will be difficult, will not need any explanation.

This bulletin will be sent free to any resident of Ohio on application to the Ohio Agricultural Experiment Station, Columbus, O.

QUARTZ FIBRES.

IN almost all investigations which the physicist carries out in the laboratory, he has to deal with, and to measure with accuracy, those subtle and to our senses inappreciable forces to which the so-called laws of nature give rise. Whether he is observing by an electrometer the behavior of electricity at rest, or by a galvanometer the action of electricity in motion; whether in the tube of Crookes he is investigating the power of radiant matter, or with the famous experiment of Cavendish he is finding the mass of the earth, — in these and in a host of other cases he is bound to measure with certainty and accuracy forces so small that in no ordinary way could their existence be detected; while disturbing causes which might seem to be of no particular consequence must be eliminated, if his experiments are to have any value. It is not too much to say that the very existence of the physicist depends upon the power which he possesses of producing at will and by artificial means forces against which he balances those that he wishes to measure.

The weight of a single grain is not to our senses appreciable, while the weight of a ton is sufficient to crush the life out of any one in a moment. A ton is about 15,000,000 grains. It is quite possible to measure with unfailing accuracy forces which bear the same relation to the weight of a grain that a grain bears to a ton.

To show how the torsion of wires or threads is made use of in measuring forces, simply hang a straw horizontally by a piece of wire. Rest on the straw a fragment of sheet-iron. A magnet so weak that it cannot lift the iron is able to pull the straw round through an angle so great that the existence of the feeble attraction is plainly evident.

Ordinary spun glass, a most beautiful material, is about one-thousandth of an inch in diameter, and this would appear to be an ideal torsion-thread. Owing to its fineness, its torsion would be extremely small, and the more so because glass is more easily deformed than metals. Owing to its very great strength, it can carry heavier loads than would be expected of it. It has every good quality but one, and that is its imperfect elasticity. For instance: if a mirror is hung by a piece of spun glass, and if you turn the mirror twice to the right, and then turn it back again, a ray of light reflected from the mirror does not come back to its old point of rest, but oscillates about a point on one side, which, however, is slowly changing, so that it is impossible to say what the point of rest really is. Further, if the glass is twisted one way first, and then the other way, the point of rest moves in a manner which shows that it is not influenced by the last deflection alone: the glass remembers what was done to it previously. For this reason spun glass is quite unsuitable as a torsion-thread. It is impossible to say what the twist is at any time, and therefore what is the force developed.

So great has the difficulty been in finding a fine torsion-thread, that the attempt has been given up, and in all the most exact instruments silk has been used. The natural cocoon fibres consist of two irregular lines gummed together, each about one two-thousandth of an inch in diameter. These fibres must be separated from one another and washed. Then each component will, according to the experiment of Gray, carry nearly 60 grains before breaking, and can be safely loaded with 15 grains. Silk is therefore very strong, carrying at the rate of from 10 to 20 tons to the square inch. It is further valuable in that its torsion is far less than that of a fibre of the same size of metal, or even of glass, if such could be produced. The torsion of silk, though exceedingly small, is quite sufficient to upset the working of any delicate instrument, because it is never constant. At one time the fibre twists one way, and another time in another, and the evil effect can only be mitigated by using large apparatus in which strong forces are developed. Any attempt that may be made to increase the delicacy of apparatus by reducing their dimensions is at once prevented by the relatively great importance of the vagaries of the silk suspension.

The result, then, is this: the smallness, the length of period, and therefore delicacy, of the instruments at the physicist's disposal, have until lately been simply limited by the behavior of silk. A more perfect suspension means still more perfect instruments, and therefore advance in knowledge.

As nothing that Mr. C. V. Boys, F.R.S., knew of could be obtained that would be of use to him, he was driven to the necessity of trying by experiment to find some new material. The result of these experiments was the development of a process of almost ridiculous simplicity.

The apparatus consists of a small cross-bow, and an arrow made of straw with a needle-point. To the tail of the arrow is attached a fine rod of quartz which has been melted and drawn out in the oxyhydrogen jet. The operator holds a piece of the same material in his hand, and, after melting their ends and joining them together, — an operation which produces a beautiful and dazzling light, — all he has to do is to liberate the string of the bow by pulling the trigger with one foot; and then, if all is well, a fibre will be drawn by the arrow, the existence of which can be made evident by fastening to it a piece of stamp-paper.

In this way threads can be produced of great length, of almost any degree of fineness, of extraordinary uniformity, and of enormous strength. A quartz fibre one five-thousandth of an inch in diameter Mr. Boys had in constant use in an instrument loaded with about 30 grains. It has a section only one-sixth of that of a single line of silk, and it is just as strong. Not being organic, it is in no way affected by changes of moisture and temperature, and so it is free from the vagaries of silk which give so much trouble. The piece used in the instrument was about 16 inches long. Had it been necessary to employ spun glass, which hitherto was the finest torsion material, then, instead of 16 inches, he would have required a piece 1,000 feet long, and an instrument as high as the Eiffel Tower to put it in.

There is no difficulty in obtaining pieces as fine as this, yards long if required, or in spinning it very much finer. Dr. Royston Piggott has estimated some of them at less than one-millionth of an inch; but, whatever they are, they supply for the first time objects of extreme smallness the form of which is certainly known, and therefore one cannot help looking upon them as more satisfactory tests for the microscope than diatoms and other things of the real shape of which we know nothing whatever.

Since figures as large as a million cannot be realized properly, it may be worth while to give an illustration of what is meant by a fibre one-millionth of an inch in diameter. A piece of quartz an inch long and an inch in diameter would, if drawn out to this degree of fineness, be sufficient to go all the way round the world 658 times; or a grain of sand just visible — that is, one-hundredth of an inch long and one-hundredth of an inch in diameter — would make 1,000 miles of such thread. Mr. Boys has made use of fibres one ten-thousandth of an inch in diameter, and in these the torsion is 10,000 times less than that of spun glass.

As these fibres are made finer, their strength increases in proportion to their size, and surpasses that of ordinary bar steel, reaching, to use the language of engineers, as high a figure as 80 tons to the inch. While these fibres give us the means of producing an exceedingly small torsion, and one that is not affected by weather, it is also true that they do not show the same fatigue that makes spun glass useless. A peculiar property of melted quartz makes threads such as these a possibility. A liquid cylinder, as Plateau has so beautifully shown, is an unstable form. It can no more exist than can a pencil stand on its point. It immediately breaks up into a series of spheres. This is well illustrated in that very ancient experiment of shooting threads of resin electrically. When the resin is hot, the liquid cylinders which are projected in all directions break up into spheres. As the resin cools, they begin to develop tails; and when it is cool enough, i.e., sufficiently viscous, the tails thicken and the beads become less, and at last uniform threads are the result.

Now, in the case of the melted quartz, it is evident, that, if it ever became perfectly liquid, it could not exist as a fibre for an instant. It is the extreme viscosity of quartz, at the heat even of an electric arc, that makes these fibres possible. The only difference between quartz in the oxyhydrogen jet, and quartz in the arc, is that in the first you make threads, and in the second are blown bubbles.

CULTIVATION OF SUGAR IN PERSIA.

THE sugar-cane was introduced into Persia from its original home in Bengal at a very remote period. The first indisputable mention, says the United States consul at Teheran, of sugar by a Western writer, is that by Moses Chorencrisis, in the fifth century, who describes the sugar-cane as he saw it growing on the banks of the Karun River, which joins the Shott-et-Arab at the head of the Persian Gulf. In the olden times, and as late as the fourteenth century, the sugar-cane was much cultivated in Susiana, the country intersected by the Karun River, and principally near Ahwaz and Jundi Shapur. Susiana was then one of the principal intermediate commercial stations between the present towns of Dizful and Shushter, and had its water from the Karun River by means of canals cut from the right bank some distance above Shushter, and from the Diz River by canals cut from the left bank, near the town of Dizful. With the decline of Jundi Shapur, in the thirteenth century, the canals were neglected, and the cultivation of sugar-cane necessarily ceased. The present Ahwaz is a small village of about fifty houses, on a mound which covers the ruins of a part of the former town. Hundreds of millstones or wheels, formerly used for squeezing the juice out of the cane, are lying about in all directions. Persian historians do not ascribe the ruin of Ahwaz to the failure of the water-supply, but to scorpions. They say that an Indian merchant, with the view of raising the price, bought up all the sugar he could, and stored it for a year or two. When he opened his stores, all the sugar had turned into scorpions. Millions of scorpions came out of the sugar-store, all the inhabitants of Ahwaz fled, and the city has remained a desert from that day. There is still current in Persia a proverb which says, "At Ahwaz sugar-cane produces scorpions;" and one of the Persian poets, referring to the ringlets of his mistress, says, "They are as deadly as the scorpions of Ahwaz." The only district in Persia where sugar-cane is now cultivated is Mazanderan, which is the principal rice-producing district, and it was probably introduced during the last century. The sugar-cane in Mazanderan requires twelve months to ripen; but the canes are small and poor, few being ever found thicker than a man's finger, and the produce is of very inferior quality, being dark and moist. Both of these defects in all probability arose from want of skill in the cultivation and preparation of this valuable plant. The sugar is mostly consumed in the province; a considerable portion, however, is exported to Gilan, and some to Russia. The canes are planted in slips with two or three joints, in February or March, and ripen about eight or nine months after, having then a height of about five feet. One mill turns out per day about 200,000 pounds of juice, and about 60 to 70 pounds of sugar. The juice, therefore, yields 30 to 35 per cent of sugar. Only raw sugar is manufactured in Mazanderan. There are no sugar-refineries. The raw sugar is sold at the place of manufacture in the villages at from three farthings to a penny a pound, and in the markets of Sari and Barfunish at from a penny to twopence a pound, according to quality. In some towns of Persia, principally Yezd and Ispahan, Jaru raw sugar was, up to a few years ago, refined, and made into loaf-sugar. The loaf-sugar made in Persia was seldom perfectly crystallized, and was on that account very soft; it was also more or less impure and dirty, the loaves not having been properly washed, and the green sirup not having been completely removed. The imported loaf-sugar becoming very cheap, sugar-refining in Persia ceased to be profitable. The general Persian word for "sugar" is *shakar*, "the sugar-cane" is *udi-i-shakar*, while "refined sugar" is *kand*, "a loaf of sugar" is *kelleh-i-kand*, "sugar-candy" is *nabat*. Persia is famous for its sugar-candy. This is made in the ordinary way, but is left to crystallize on strings in a bowl of earthenware or china. The strings are kept at the bottom of the bowl by a piece of lead, and at the top by strips of wood. When taken out of the bowl, it retains its shape, and is called *kasch-i-nabat*; i.e., a bowl of candy. Consul Schindler is of opinion that sugar-cane would thrive well in some districts of Persia and southern Persia, at altitudes of from 1,000 to 3,000 feet above the level of the sea. The plain of Bugh-i-Mailik, east of Shushter, at an elevation of 2,600 feet; that of Shapur, west of Shiraz, elevation 2,500 feet; those of Fihift and Rudbar, south of Kerman, elevation 2,500 feet, — appear to him to be eminently suited to the cultivation of the sugar-cane.

FRUIT-CANDYING INDUSTRY OF LEGHORN.

THE English consul at Leghorn says that that city occupies the first place in Italy, and perhaps throughout the Mediterranean, for the preparation of the candied citron and orange peel so largely used in all branches of confectionery — citron being brought for this purpose from Corsica, from Sicily, from Calabria and other southern provinces of Italy, from Tunis and Tripoli, and even from Morocco; while the candied peel of the fruit is exported to North America, to the United Kingdom, and to Hamburg for distribution throughout Germany. Sugar also is imported for the purpose of the manufacture from Egypt. The wood of the boxes in which the candied peel is packed comes from Trieste, and the immense earthenware vessels necessary for the saturation of the fruit in

sugar-sirup are made in the neighborhood of Florence. The oranges imported into Leghorn, whether for consumption or for candying, are nearly all brought from the islands of Sicily, Sardinia, and Corsica. In all the countries contributing the raw fruit for this industry, it is treated in the same manner for the over-sea passage. The fruit is simply halved and placed in hogsheads or large casks filled with a fairly strong solution of brine, the fruit being halved merely to insure thorough preservation of the rind by an equal saturation of the interior as well as the exterior surface. In these casks it arrives at the doors of the manufactory. The first process to which it is then subjected is the separation of the fruit from the rind. This is done by women, who, seated round a large vessel, take out the fruit, skilfully gouge out the inside with a few rapid motions of the forefinger and thumb, and, throwing this aside, place the rind unbroken in a vessel alongside them. The rind is next carried to large casks filled with fresh cold water, in which it is immersed for between two and three days to rid it of the salt it has absorbed. When taken out of these casks, the rinds are boiled, with the double object of making them tender and of completely driving out any trace of salt that may still be left in them. For this purpose they are boiled in a large copper caldron for a time varying from one to two hours, according to the quality of the fruit and the number of days it has been immersed in brine. When removed from this caldron, the peel should be quite free from any flavor of salt, and at the same time be sufficiently soft to absorb the sugar readily from the sirup in which it is now ready to be immersed. The next process to which the rind is subjected is that of a slow absorption of sugar, and this occupies no less than eight days. The absorption of sugar by fresh fruit, in order to be thorough, must be slow, and not only slow but also gradual; that is to say, the fruit should be at first treated with a weak solution of sugar, which may then be gradually strengthened, for the power of absorption is one that grows by feeding. The fruit has now passed into the saturating-room, where on every side are to be seen long rows of immense earthenware vessels, about four feet high and two feet and a half in extreme diameter, in outline roughly resembling the famed Etruscan jar, but with a girth altogether out of proportion to their height, and with very short necks and large open mouths. All the vessels are filled to the brim with citron and orange peel in every stage of absorption; that is to say, steeped in sugar-sirup of about eight different degrees of strength. This process almost always occupies eight days, the sirup in each jar being changed every day; and with vessels of such great size and weight, holding at least half a ton of fruit and sirup, it is clearly easier to deal with the sirup than with the fruit. To take the fruit out of one solution and to place it into the next stronger, and so on throughout the series, would be a very tedious process, and one, moreover, injurious to the fruit. In each of these jars, therefore, there is fixed a wooden well, into which, a simple hand suction-pump being introduced, the sirup is pumped from each jar daily into the adjoining one. A slight fermentation next takes place in most of the jars; but this, so far from being harmful, is regarded as necessary, but is not allowed to go too far. There is yet another stage, and that perhaps the most important, through which the peel has to pass before it can be pronounced sufficiently saturated with sugar. It is now boiled in a still stronger sirup of a density of forty degrees by the testing-tube; and this is done in large copper vessels over a slow coke fire, care being taken to prevent the peel adhering to the side of the vessel by gently stirring with a long paddle-shaped ladle. This second boiling occupies about an hour. Taken off the fire, the vessels are carried to a large wooden trough, over which is a coarse open wire netting. The contents are poured over this, and the peel distributed over the surface of the netting, so that the sirup, now thickened to the consistency of treacle, may drain off the surface of the peel into the trough below. The peel has now taken up as much sugar as is necessary. Next comes the final process, — the true candying, or covering the surface of the peel with the layer of sugar-crystals which is seen on all candied fruits. To effect this, a quantity of crystallized sugar (at Leghorn the same quality of sugar is used as is employed in the preparation of the sirup) is dissolved in a little water; and in this the now dried peel, taken off the wire netting, is immersed. The same copper vessels are used, and a mixture is again boiled over a slow fire. A short boiling will suffice for this the last process; for the little water will quickly be driven off, and the sugar, upon cooling, will form its natural crystals over the surface of the fruit. Poured off from these vessels, it is again dried upon the surface of the wire netting, as before described. The candying is now complete, and the candied peel is ready for the packing-room, to which it is carried in shallow baskets. In the packing-room may be seen hundreds of boxes of oval shape and of different sizes, for each country prefers its boxes to be of a particular weight; Hamburg taking the largest (of 15 and 30 kilograms), the United States preferring smaller (of 10 and 12 kilograms), while England takes the smallest (of 5 kilograms), and one containing about 7 English pounds.

BOOK-REVIEWS.

Force and Energy. A Theory of Dynamics. By GRANT ALLEN. New York, Longmans. 8°. $2.25.

IN this work the author presents a new view of some of the concepts of physical science. The current views he holds to be erroneous, and, though he says that he puts forth his work with profound diffidence, it is evident that he feels great confidence in its correctness. The essential point in his theory is the distinction he draws between force and energy, both of which he includes under the term "power." Power he defines as "that which initiates or terminates, accelerates or retards, motion." He then goes on to divide power into two varieties, — force, or aggregative power; and energy, or separative power. Among forces he reckons gravitation, cohesion, and chemical affinity; and among energies, heat, muscular power in many cases, and, in short, whatever separates bodies or particles from one another. This theory he first states in an abstract form, and afterwards proceeds to an account of the various actual concrete forces and energies in the universe, mechanical, chemical, and vital, endeavoring to show that his views are not only consistent with the known facts and laws of physical science, but are essential to a correct understanding of them.

As to the merits of Mr. Allen's views, we shall not now enter on any elaborate criticism; but certainly his use of terms is not accordant with the common practice either of scientists or of writers generally. The term "power" has always been used in philosophy to denote causality viewed hypothetically; as when we say that fire has power to melt wax, meaning that it will melt wax if the two are brought into contact. Force, on the other hand, is commonly used to mean what Mr. Allen calls power; namely, any cause that in any way affects motion. The distinction Mr. Allen draws between separative and aggregative powers is of course a real distinction; and yet he himself finds it impossible to maintain it with perfect consistency. Thus, he calls the motion of a falling body and the contraction of a cooling body, energies, although they are obviously aggregative; and his attempt to remove the inconsistency does not seem successful. We commend the work, however, to the attention of our readers, as it is well written and with earnestness of purpose, and will doubtless be provocative of thought.

Life of Charles Blacker Vignoles. By his son, Rev. OLINTHUS J. VIGNOLES. New York, Longmans. 8°. $5.

THE subject of this memoir was one of the pioneers in railroad engineering, a work which in its early development required far more inventiveness and fertility of resource than is the case now; and his son has done well in laying an account of his life before the public. The book is well written, and with as much impartiality as could be expected in so near a relative of the hero. Vignoles was born in the last decade of the eighteenth century, and lived to the ripe age of eighty-two. He lost his parents in early life, and went to live with his maternal grandfather, with whom he afterwards had an irreconcilable quarrel. On reaching manhood, he entered the army, and by the aid of influential friends and his own merits rose in a few years to the position of lieutenant; but the conclusion of peace after Waterloo deprived him of the hope of further advancement, and he came over to America, and went to work as a civil engineer. He was employed in South Carolina and other Southern States, and by his experience there prepared himself for the more difficult work of railroad engineering, in which

he was soon to engage. Returning to England, he was in a few years employed to assist in laying out and building the Liverpool and Manchester Railway, on which Stephenson's locomotive engine attained its memorable success. After a while he quarrelled with Stephenson, and parted from him; but he speedily found employment elsewhere, and for many years was occupied on various railroads in Great Britain and Ireland, and afterwards in Germany, Spain, and Brazil. He also built the suspension-bridge over the Dnieper River at Kief, — a structure half a mile long, the construction of which occupied seven years.

Such were the works performed by Vignoles; and they entitle him, as his biographer justly says, to a high position among the pioneers of modern engineering. The man had also some excellent personal qualities, such as honesty, energy, and conscientiousness in work; he had considerable literary skill, as the extracts from his diary and letters show; and he was considered a pleasant companion in society. On the other hand, as his biographer admits, his temper was not the best; and besides his quarrel with his grandfather, which is left unexplained, he had others with Stephenson and Brunnel, which are passed over lightly in this book, but which were evidently not to his credit. He was also unskilful financially, and at one time lost eighty thousand pounds through his own imprudence, with the result that he had to begin all anew. In spite of his faults, however, he was a useful man; and the record of his life is an interesting story, particularly for members of the engineering profession and for all persons interested in railway history.

AMONG THE PUBLISHERS.

THE Catholic Publication Society Company will publish immediately "An Explanation of the Constitution of the United States of America," prepared for the use of Catholic schools and academies, by Francis T. Furey.

— Professor Max Müller's new book on "Natural Religion," being the Gifford lectures which he delivered at Glasgow last year, will be issued here in a few days by Longmans, Green, & Co.

— Lee & Shepard will publish shortly "Pens and Types, or Hints and Helps to Those who Write, Print, Speak, Teach, or Read," a volume full of new and original matter, by Benjamin Drew.

— The Forest and Stream Publishing Company have published a book on "Log Cabins and How to Build and Furnish Them," by William S. Wicks, illustrated with many plans and other illustrations.

— Messrs. Ginn & Co. have issued a catalogue and announcements for 1889. Although this catalogue is complete, yet, as it is primarily designed for high-school and college instructors, it gives but very little space to their common-school publications.

— The delegates of the Clarendon Press will shortly issue Mr. Oliver Aplin's "Birds of Oxfordshire;" the second volume (treating of electro-dynamics) of Messrs. Watson and Burbury's "Mathematical Theory of Electricity and Magnetism;" and a new edition of the fourth volume (on the dynamics of material systems) of Professor Bartholomew Price's "Treatise on Infinitesimal Calculus."

— Messrs. Trübner & Co. will publish, probably in October, "An Account of the Aborigines of Tasmania, their Manners, Customs, Wars, Hunting, Food, Morals, Language, Origin, and General Characteristics," by Henry Ling Roth, assisted by E. Marion Butler. The work will contain a chapter on the osteology, by Dr. J. G. Garson, and a preface will be contributed by Dr. E. B. Tylor. Numerous autotype plates, from original drawings made by Edith May Roth, will illustrate the text. The edition will be strictly limited to subscribers.

— Funk & Wagnalls have in preparation an "Encyclopædia of Missions." The encyclopædia proposes to give the history, geography, ethnology, biography, and statistics of missions, from the apostolic times to the present. There will be full maps, diagrams, and a copious index. The best authorities on missions in this country and in England have been consulted, and the materials are being furnished from all parts of the mission-field, by those best qualified to give the most accurate and complete information.

— Rand, McNally, & Co. have just issued the "Globe Series of School Maps," an entirely new series, newly engraved on a large scale, and corrected by the latest official and private data. The series comprises seven maps, — the United States, North America, South America, Europe, Asia, Africa, and the world on Mercator's projection. All excepting the map of the world (which is 58 by 41 inches) are 66 by 44 inches, — a size which permits of their use in the largest schoolrooms, where the details can be seen by the entire class.

— The annual report of the Ohio Agricultural Experiment Station will hereafter be issued in the form of a monthly bulletin, the issues of each calendar year constituting a volume. These bulletins will be consecutively paged, and the December number will contain an index to the entire series of the year, thus putting them in convenient shape for preservation for reference. By this change the results of the station's work for each season will be placed before the farmers of the State nearly or quite a year earlier than was possible when the annual report was issued in a single volume at the close of the year. The bulletins will be sent to any resident of Ohio free of charge, on application to the Experiment Station, Columbus, O.

— Messrs. Ginn & Co. announce for publication Sept. 1 the "Common School Song-Reader: A Music-Reader for Schools of Mixed Grades," by W. S. Tilden, teacher of music in the State Normal School, Framingham, Mass. This book is designed to adapt and apply the principles of the national system of musical instruction to those schools where the special conditions and grading are such that the full and regularly graded series cannot be so conveniently and effectively used. While containing an interesting repertory of school-songs, new and old, which fits it for use where systematic instruction in music is not attempted, it is especially intended for those schools in which the principles of elementary instruction and singing by note are to be taken up according to the most approved methods. Very full instructions for teachers are given at each step. Besides the work in the reading course, a collection of easy pleasing songs in one, two, and three parts (with bass clef), will be found.

— Robert Grant, the author of "The Confessions of a Frivolous Girl," has written the third article in *Scribner's* Fishing Series for the August issue, entitled "Tarpon Fishing in Florida." Mr. Grant, during the past winter, made a special trip to St. James City, Fla., to gather material for this article, and had the good fortune during the second day's fishing to capture an enormous tarpon, six feet long, and weighing 132 pounds. His description of his three-hours' fight with this tremendous fish is one of the most graphic pieces of sportman's literature of recent years. The article is fully illustrated from photographs made at the time, which have been carefully redrawn by Burns, Woodward, and others. President Henry Morton, in his article on "Electricity in Lighting," will describe the actual processes of manufacturing dynamos and incandescent lights as carried on in some of the largest factories in this country. The illustrations add very much to these descriptions, as they are made from instantaneous photographs taken while the men and women are at work.

— Messrs. Ginn & Co. announce for publication in the College Series of Greek authors, "Euripides, Iphigenia among the Taurians," edited by Professor Isaac Flagg. Professor Flagg's "Iphigenia" is not based upon any other commentary, but is an independent work, adapted to the needs of American colleges, and designed to facilitate the sympathetic study of this most charming and justly celebrated drama of Euripides. Since the play is well suited to be taken up as a first tragedy in a course of Greek reading, both the introduction and the notes have been written with especial regard to the enlightenment of beginners in the dramatic literature. At the same time, the finer insight and higher cravings of the advanced reader are constantly remembered. The introduction sets forth the celebrity of the play, with quotation in full of the most memorable classical passages that bear upon it; sketches the legend in its literary and popular development; ex-

plains the *rationale* of the plot with reference to the Aristotelian method of analysis; discusses the artistic structure of the tragedy as to prologue, narratives, *dénouement*, etc.; and gives a complete exposition of the metres and technique. In the notes, the grammatical material is presented with sufficient fulness, but mostly in a condensed form, with references to Goodwin and to Hadley & Allen; while the higher and more edifying matters of exegesis receive explicit treatment.

— A sketch of the colleges of Wisconsin by William F. Allen and David E. Spencer, recently published by the United States Bureau of Education, does not aim to give more than a very general outline of the career of each. In the sketch of the State Uuiversity, only such matters are dwelt upon as have had a direct bearing upon the fortunes of the institution, and those which concern its relations to the educational movements that have taken place during its history, to the school system of the State, and to the practical progress of the people. While the graduates of the university are filling positions in many cases of greatest trust and usefulness, it is yet too early to estimate the precise drift and measure of the influence of the school upon the educational, political, and social life of the community. The older graduates are but now in the prime of life, in the midst of the years of greatest activity and influence. The university has not a sufficiently distant past to make its inner life of special interest as matter of history; nor does it fall within the scope of this sketch to trace, in any special manner, the influence of the graduates of the institution beyond its walls. There is considerable variety in the character of the chapters devoted to the five private colleges, since the sketches for the greater part are adapted from articles previously published; but the leading features in the character of each college, and the scope and tendency of its work, are indicated. Many other colleges have from time to time, especially in the first twenty-five or thirty years of our history, been established in Wisconsin. Of two of these which still exist, brief notices are given at the end of the work.

— With the June number commences the second volume of *Insect Life*. The last number was somewhat delayed by the preparation of the extensive indexes, which, however, will greatly increase the value of Volume I. Largely through the kindness of the authorities of the Government Printing-Office, the numbers during the past year appeared more regularly and promptly than anticipated, and it is hoped to continue this regularity through the coming volume. As stated in the salutatory to the first volume, however, the force of the Division of Entomology is so actively engaged during the larger part of the year with field-work and experimentation, that some lack of promptness in publication cannot but ensue. The publication of the bulletin met with even more favor than was hoped at the start, and almost no adverse comments have reached the editor's eye. The only criticism noticed was published in the review column of the *Atlantic Monthly*, in which slight exception was taken to the idea of the publication of a magazine by the government, which, by its free distribution, would compete on unfairly advantageous terms with private enterprises.

— A monograph on "Education in Georgia" has been prepared by C. E. Jones of Augusta, Ga., a son of the historian of that State, and late graduate student of Johns Hopkins University. This work was undertaken under the supervision of Dr. Herbert B. Adams, editor of the present series of Contributions to American Educational History, published by the United States Bureau of Education. Mr. Jones discusses the history of education in the State of Georgia. The paper opens with a sketch of the educational advantages afforded by the few schools which existed during the colonial epoch. The formation and conduct of academies after the revolutionary war are next considered. The author then addresses himself to a review of the elementary education afforded in the rural schools, the teachers of which were supported by the tuition derived from the attending scholars. Carefully, and with an exhaustive analysis of the laws and constitutional provisions bearing upon the subject, are the rise, development, and decadence of the "poor school system," noted. Prior to the late civil war, steps had been taken to establish a system of common schools accessible to all white children between the ages of six and eighteen. They were, however, interrupted by the war, and it was not until some five or six years after the cessation of hostilities that the present system of public schools was inaugurated. Having discussed these preliminary topics, Mr. Jones turns his attention to the history and present status of higher education in Georgia, as represented in the university of the State and its branches, in various denominational colleges, and in special institutions designed to facilitate studies in law, medicine, theology, science, and art. All charitable and literary institutions ministering to intellectual, social, and moral improvement receive due consideration.

— The August *St. Nicholas* contains a full and interesting article by Dr. Jastrow, concerning the late Miss Laura Bridgman, with a portrait, — an exceedingly good likeness; Dr. Charles S. Robinson offers to mathematicians some curious speculations as to the present value of "An Egyptian Girl's Gold Necklace," if its value is regarded as having increased at compound interest for over three thousand years; and "Among the Florida Keys" is continued.

— In the August *Magazine of American History*, Dr. Everett's "Earliest American People" touches upon a theme dear to every antiquarian reader. "England's Struggle with the American Colonies," by Dr. William M. Taylor, is one of the prominent features of the number. The author traces the events in England, the needless misunderstandings and the crude mistakes which led to the war of the Revolution, and bestowed upon the Colonies their independence, and he does it so that fresh life is infused into the narrative; and one of the best condensed accounts of this part of our history extant is the result. Hon. J. O. Dykman concludes his series of papers of "The Last Twelve Days of Major André" in this number. J. P. Dunn, jun., contributes "The Founding of Post Vincennes," and Mr. William S. Pelletreau writes of "The Philipse Patent in the Highlands," furnishing portraits of Col. and Mrs. Roger Morris, and an interesting map. Mrs. Lamb's opening article is a vigorous pen-picture of the "Career of a Beneficent Enterprise," — now one hundred and four years old, — "The General Society of Mechanics and Tradesmen," and this paper is profusely illustrated. A portion of the address of President Merrill E. Gates of Rutgers College, to the class of 1889, appears in these pages, entitled "Life and its Activities — the bearing of the Past on the Present and Future;" and there is a "Tribute to Mrs. Rutherford B. Hayes," from the editor. The frontispiece of the number is a portrait of Alexander Hamilton. "The Wit and Wisdom of Keokuk, Chief of the Sacs and Foxes," is one of the short articles; and an unpublished Washington letter is given to the reader in Origina Documents.

— The subject of a monograph, just published by the United States Bureau of Education, is the history of education in North Carolina. In this monograph Mr. Charles Lee Smith, who was trained in historical methods at the Johns Hopkins University, gives the results of a thorough and careful study of the educational history of his native State. For North Carolina this is pioneer work. The writer has traced the genesis and development of education in North Carolina from the first settlement of that State to the present time. For this purpose he is the first to exploit the colonial records, the publication of which was begun last year, and the early laws of the State. He has also utilized early newspaper files, and all the published biographical and historical works relating to his State to be found in the public libraries of Raleigh, Washington, and Baltimore, besides certain private collections and personal correspondence. The government is perhaps to be censured that schools were not earlier provided. It is an error, however, to suppose, as has been stated by some writers, that there were no good schools in the State previous to the Revolution, for it is shown that there were many creditable institutions, several having a wide reputation. The higher education has been principally treated in this sketch, although the history of primary and secondary instruction has not been neglected. The influence of certain classes of immigration and of institutions outside the State, especially of Princeton, which previous to the establishment of the

University of North Carolina was largely patronized by the young men of that State, is clearly shown. The sketch which is given of the University of North Carolina is the first full account of that institution which has ever been written. The writer thinks no institution of this country has a more honorable record; and it is claimed, that, in proportion to the number of its alumni, it stands second to none in the number of the distinguished public men it has given to the State and nation.

— Judge Benjamin F. Burnham has published through Messrs. Macdonald & Co. of Boston a little pamphlet bearing the title "Elsmere Elsewhere." What meaning there is in this title we are unable to see; but the book has considerable interest as marking the rapid change now in progress in this country in men's views of Christianity. The author's standpoint is essentially that of Mrs. Humphry Ward and other liberal English thinkers, and will probably seem pretty radical to many people in this country. He reviews the leading points of the Christian creed, and shows what changes are taking place or have already taken place in the interpretation of them; and all these changes he holds to be wise and beneficial. The style of the work is generally clear, and always concise, so that it presents a large amount of matter in a small compass. The appendix contains extracts from Mrs. Ward, Professor Huxley, and others, and also some curious notes about "demoniacal possession" and other "occult" phenomena.

— Of his purpose in building the Eiffel Tower, Mr. Eiffel says in the July number of the *New Review* (Longmans, Green, & Co.), "The beginning was difficult, and criticism as passionate as it was premature was addressed to me. I faced the storm as best I could, thanks to the constant support of M. Lockroy, then minister of commerce and industry; and I strove by the steady progress of the work to conciliate, if not the opinion of artists, at least that of engineers and scientific men. I desired to show, in spite of my personal insignificance, that France continued to hold a foremost place in the art of iron construction, in which from the earliest days her engineers have been more particularly distinguished, and by means of which they have covered Europe with the creations of their talent. Doubtless you are not ignorant that almost all the great engineering works of this nature, in Austria, Russia, Italy, Spain, and Portugal, are due to French engineers; and the traveller discovers with pride, as he passes through foreign countries, the traces of their activity and their science. The tower, 1,000 feet high, is, before every thing, a striking manifestation of our national genius in one of its most modern developments; and this is one of the principal reasons for its existence. If I may judge by the interest which it inspires, abroad as well as at home, I have reason to believe that my efforts have not been unavailing, and that we may make known to the world that France continues to lead the world, that she is the first of the nations to realize an enterprise often attempted or dreamed of: for man has always sought to build high towers to manifest his power, but he soon recognized that the laws of gravity hampered him seriously, and that his means were very limited. It is owing to the progress of science, of the engineer's art, and of the iron industry, that we are enabled to surpass in this line the generations which have gone before us by the construction of this tower, which will be one of the characteristic feats of modern industry."

— The *Quarterly Journal of Economics* for July opens with a paper by Edward Cummings on "The English Trades-Unions," the special object of which is to show the present character and tendency of these associations. The writer points out that the policy of strikes is much less favored by the unions than it was a few years ago, and more care and intelligence shown in ordering strikes. On the other hand, the unions are assuming more and more the character of benefit societies, much to the gratification of the best friends of workingmen, and much to the dissatisfaction of the socialists, who charge the members of the unions with "apostasy to the cause of labor." Mr. Cummings also calls attention to the fact that the English unions really comprise but a small portion even of the skilled workmen of the country, but thinks these are "the flower of their respective trades." To students of the labor problem this article will be useful; and the same may be said of another in this number of the journal, that on "The International Protection of Workmen." It is a summary by A. C. Miller of a work by Dr. Georg Adler of Freiburg, with some account of the discussion the work has raised. Dr. Adler is anxious for legislation restricting the hours of labor, prohibiting the employment of children, and otherwise protecting workmen and their families against some of the evils they now suffer; but he thinks this cannot be enacted by any one nation independently, since the effect would be to raise the price of labor, and thus impede the nation in its competition with foreigners: hence he wants an international agreement on the subject, and believes that the end in view can be attained in no other way. Still another article on the labor question is "A New View of the Theory of Wages," by Stuart Wood, being a continuation of one published by him in the journal last October. We noticed the former article briefly at the time, and this one merely develops somewhat further the theory there laid down. The remaining article in this number is by Professor Dunbar, on "The Direct Tax of 1861." It gives a full and clear account of the levying and collection of the tax, so far as it was collected, and advises against refunding it to the States. The writer thinks it will be refunded, however, and he is probably right; for Congress appears to be searching for every available means of spending the money in the national treasury. Besides these longer articles, the journal has some interesting "Notes and Memoranda," including an account of the rise and fall of the French Copper Syndicate, which forms a curious chapter in industrial history.

INDUSTRIAL NOTES.

Natural Memory Method.

WE take the following extract from an editorial in the *Journal of Education*, Boston: "We have taken no part in the Loisette-Fellows-Pick memory controversy, because we have not thought the advantage to be had from all systems of mnemonics sufficient to make it of interest to the world. Systems of the past have often required more effort to remember senseless things than would be required to remember the desired things. Any system based upon sounds, upon having letters stand for special figures, is impracticable for every-day affairs or educational uses. So long as mnemonics meant any thing of this kind, we merely examined them as curiosities; but within the past year John A. Shedd of New York City has discovered a purely original system, which is high above any unnatural system. It is simple (it may be understood in fifteen minutes), natural (all its principles may be learned in an hour by the dullest student), suggestive (two hours' practice makes it easy to use it every day, and almost literally every hour of life), comprehensive (it adapts itself to various subjects and branches of knowledge). There is not a moment's drudgery in learning it, not a feather-weight's burden in remembering it, and no perplexity in applying it. It is educational and helpful, entirely apart from the memory phase of the subject."

Electrical Accumulators.

Judge Coxe, in the United States Circuit Court for the southern district of New York, rendered a decision on July 22, re-affirming his former judgment in favor of The Electrical Accumulator Company, in its suit against The Julien Electric Company to establish the validity of the Faure secondary battery patent, and denying The Julien Company's motion for a rehearing.

The Julien Company, in its argument, claimed, among other things, that it could manufacture batteries by the "dry-powder" process as good as or better than it was possible to manufacture under the Faure process by the use of a "paste;" and in this connection Judge Coxe very aptly says, "If it be true that Faure's batteries are inferior to or no better than others, the question naturally suggests itself, 'Why are not defendants content to use other batteries?' A rehearing is denied."

According to the views of The Electrical Accumulator Company, this gives the complete control of the manufacture and use of secondary batteries to that company, which owns the Faure-Sellon-Volckmar patents.